

What is claimed is:

1. Composite oxide powder, comprising particles of a composite oxide of an oxide of a metal M_1 and an oxide of a metal M_2 which does not dissolve in said oxide of said metal M_1 , said oxide of said metal M_1 and said oxide of said metal M_2 being dispersed at the nanometer level.

2. Composite oxide powder according to claim 1, wherein when microanalysis on one of said composite oxide particles not overlapped is carried out by means of energy dispersive X-ray spectrometry (EDS) using a field emission scanning transmission electron microscope (FE-STEM) with a beam of 5-nm diameter, said metal M_1 and said metal M_2 are detected at composition in $\pm 20\%$ of charge composition at 90% or more of respective analytical points.

3. Composite oxide powder according to claim 1, wherein when microanalysis on one of said composite oxide particles not overlapped is carried out by means of energy dispersive X-ray spectrometry (EDS) using a field emission scanning transmission electron microscope (FE-STEM) with a beam of 0.5-nm diameter, said metal M_1 and said metal M_2 are detected at composition in $\pm 20\%$ of charge composition at 90% or more of respective analytical points.

4. Composite oxide powder according to claim 1, further comprising:

particles of said oxide of said metal M_2 ,

wherein a mixture in which said composite oxide particles and

said particles of said oxide of said metal M_2 are dispersed at the level of not more than 50 nm being contained by 90% or more of the total weight of said composite oxide powder.

5. Composite oxide powder according to claim 1, wherein said metal M_1 is Ce.

6. Composite oxide powder according to claim 1, wherein said metal M_2 is at least one element selected from the group consisting of Al, Ti and Si.

7. Composite oxide powder according to claim 6, wherein said metal M_2 is Al.

8. Composite oxide powder according to claim 1, wherein said oxide of said metal M_1 is contained in an amount of 50 % or more of the total weight of said composite oxide powder.

9. Composite oxide powder according to claim 8, wherein said oxide of said metal M_1 is contained in an amount of 75 % or more of the total weight of said composite oxide powder. 47

10. Composite oxide powder according to claim 1, further comprising an oxide of a metal M_3 which can dissolve in at least one of said oxide of said metal M_1 and said oxide of said metal M_2 .

11. Composite oxide powder according to claim 10, wherein said metal M_3 is at least one element selected from the group consisting

of Zr, alkaline earth metals and rare earth elements.

12. Composite oxide powder according to claim 5, wherein cerium oxide after calcination at 600 °C for 5 hours has a crystallite diameter of 5 to 10 nm, which is calculated from a half width of an X-ray diffraction peak of CeO_2 (220).

13. Composite oxide powder according to claim 5, wherein cerium oxide after calcination at 800 °C for 5 hours has a crystallite diameter of 10 to 20 nm, which is calculated from a half width of an X-ray diffraction peak of CeO_2 (220).

14. Composite oxide powder according to claim 5, wherein cerium oxide after calcination at 1000 °C for 5 hours has a crystallite diameter of 35 nm or more, which is calculated from a half width of an X-ray diffraction peak of CeO_2 (220).

15. Composite oxide powder according to claim 1, wherein pores of 3.5 to 100 nm in diameter have a volume of 0.07 cc/g or more after calcination at 600 °C for 5 hours, and pores of 3.5 to 100 nm in diameter have a volume of 0.04 cc/g or more after calcination at 800 °C for 5 hours.

16. Composite oxide powder according to claim 1, wherein pores of 3.5 to 100 nm in diameter have a volume of 0.13 cc/g or more after calcination at 600 °C for 5 hours, and pores of 3.5 to 100 nm in diameter have a volume of 0.10 cc/g or more after calcination at 800 °C for 5 hours.

17. A method of producing said composite oxide powder recited in claim 1, comprising the steps of:

preparing an aqueous solution or water-contained solution of a chemical compound of a metal M_1 and a chemical compound of a metal M_2 an oxide of which does not dissolve in an oxide of said metal M_1 ;

precipitating said oxide of said metal M_1 or a precursor of said oxide of said metal M_1 and said oxide of said metal M_2 or a precursor of said oxide of said metal M_2 or a chemical compound of said oxides or said precursors from said solution; and

then calcining said precipitate.

18. A method of producing said composite oxide powder recited in claim 10, comprising the steps of:

preparing an aqueous solution or water-contained solution of a chemical compound of a metal M_1 and a chemical compound of a metal M_2 an oxide of which does not dissolve in an oxide of said metal M_1 , and a chemical compound of a metal M_3 an oxide of which can dissolve in at least one of said oxide of said metal M_1 and said oxide of said metal M_2 ;

precipitating said oxide of said metal M_1 or a precursor of said oxide of said metal M_1 , said oxide of said metal M_2 or a precursor of said oxide of said metal M_2 and said oxide of said metal M_3 or a precursor of said oxide of said metal M_3 , or a chemical compound of said oxides or said precursors from said solution; and

then calcining said precipitate.

19. A method of producing composite oxide powder according to

claim 17, wherein hydrogen peroxide is added in obtaining said precipitate.

20. A method of producing composite oxide powder according to claim 17, wherein one of said precipitate of said precursor of said oxide of said metal M_1 and said precipitate of said precursor of said oxide of said metal M_2 is obtained prior to the other.

21. A method of producing composite oxide powder according to claim 17, wherein said precipitation is carried out by using neutralization reaction and it takes 10 minutes or more from the start to the end of said neutralization reaction.

22. A method of producing composite oxide powder according to claim 17, wherein said precipitate is aged in a suspended state in which water or a water-contained solution is a dispersion medium or in a state in which there is abundant water in a closed system consisting of said precipitation, steam and water.

23. A method of producing composite oxide powder according to claim 22, wherein said aging is carried out at or above room temperature.

24. A method of producing composite oxide powder according to claim 23, wherein said aging is carried out in the temperature range of 100 to 200 °C.

25. A method of producing composite oxide powder according to

claim 24, wherein said aging is carried out in the temperature range of 100 to 150 °C.

26. A catalyst, comprising:

a catalyst support which includes said composite oxide powder recited in claim 1; and

a noble metal loaded on said catalyst support.

27. A catalyst, comprising:

a catalyst support which includes said composite oxide powder recited in claim 1, and a solid solution or composite oxide of zirconia and yttria; and

a noble metal loaded on said catalyst support.

28. A catalyst according to claim 26, wherein said noble metal comprises at least Pt.

29. A catalyst according to claim 27, wherein said noble metal comprises at least Pt.

30. A catalyst according to claim 27, wherein the compositional ratio by weight of said solid solution or said composite oxide of zirconia and yttria to said composite oxide powder is 0 to 100 - 100 to 0 exclusive.

31. A catalyst according to claim 27, wherein the molar ratio of said zirconia and said yttria is $1 \leq \text{Zr/Y} \leq 4.5$ in terms of metal elements.